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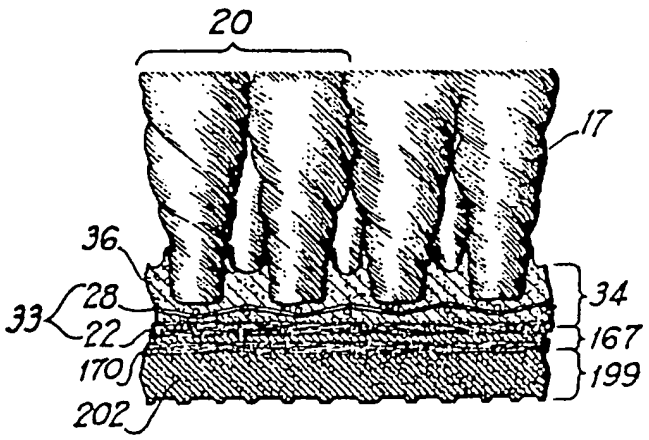

(57) Abstract

A fusion bonded carpet (199) with a latex formulation pile yarn backing adhesive (36) which includes vinyl acetate-ethylene, ethylene-vinylacetate, styrenebutadiene, latex polyvinyl chloride, polyvinylidene chloride, vinyl acetate acrylic acid or ester, styrene acrylic acid or ester, acrylic or methacrylic acid and their esters, or copolymers of these compounds.

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LATEX FUSION BONDED PILE CARPETS AND CARPET TILE

Background of the Invention

This invention relates to fusion bonded pile carpet and carpet tile which use latex as the yarn-locking adhesive and to production methods for such carpet and carpet tile.

Pile carpet is generally manufactured in one of two ways. The pile yarn may be woven or tufted through a primary backing. The yarn is then secured to the primary backing with an adhesive precoat. This type of carpet in which yarn is mechanically as well as adhesively attached to backing is generally termed "woven" or "tufted" carpet. Alternatively, yarn may be cut or looped and positioned to form a pile layer that is then secured to the primary backing with adhesive. Carpet of this type is commonly referred to as "fusion bonded" carpet.

Fusion bonded carpet is generally categorized by the way the pile yarn layer is produced. In an "I-tuft" process, yarn is first cut into short, straight strands, and then the yarn ends are bonded to a primary support backing with adhesive. In a "U-tuft" process, a pile yarn layer is formed of folded yarn strands. The folded sections of the strands are then secured to the primary backing with an adhesive layer such that in the final carpet product, both ends of each cut strand protrude from the adhesive base.

The most widely used method of manufacture of fusion bonded carpet presently involves the use of a nonlatex PVC (polyvinyl chloride) plastisol formulation as the bonding adhesive. Typically, PVC plastisol is dispensed over a support layer to form an adhesive layer that penetrates into the support layer. The adhesive layer is then contacted with pile forming yarn. The PVC plastisol is cured, creating a product

in which the yarn fibers are secured in the PVC layer and thereby bonded to the support layer. Increased strength may be obtained by bonding a secondary backing to the support layer.

In order to make a durable fusion bonded carpet in which the support layer does not peel away from the secondary backing, the adhesive which has permeated into the support layer must contact and bond with the material forming or adhering the secondary backing. The use of a nonlatex plasticized PVC as the yarn locking adhesive limits the variety of backing structures that may be applied to the carpet. This is true because nonlatex PVC plastisol does not bond strongly to common carpet backing materials such as bitumen, EVA (ethylene-vinylacetate), APP (atactic polypropylene), hot melts, urethanes, and SBR (styrene-butadiene). Furthermore, PVC plastisol is relatively expensive.

A fusion bonded carpet which does not use PVC as the pile yarn adhesive is described in United States Patents 4,371,576 and 4,576,665. The carpet is prepared by forcing a heated hot melt adhesive through a liquid permeable support layer to contact with the pile forming yarn on the opposite side of the base layer. The adhesive is then allowed to cool, during which time the pile forming yarn and support layer are secured.

Summary of the Invention

The present invention is a fusion bonded carpet in which the pile yarn is secured in a latex adhesive base and methods of manufacture of such carpet. The latex adhesive base is compatible with a wide variety

of adhesives and secondary backings, which provides the carpet manufacturer with a greater flexibility in choosing materials for carpet construction. Latex adhesives provide strong fiber lock and wear durability. Furthermore, latex is relatively inexpensive, and has good combustion performance.

Examples of latexes which may be used in the present invention include vinyl acetate-ethylene, ethylene-vinyl acetate, styrene-butadiene, latex polyvinyl chloride, polyvinylidene chloride, vinyl acetate acrylic acid or ester, styrene acrylic acid or ester, acrylic or methacrylic acid or their esters, and copolymers of these compounds.

It is therefore an object of this invention to provide a fusion bonded carpet which has a yarn locking adhesive which is compatible with a wide variety of adhesives and secondary backing materials.

It is another object of this invention to provide a fusion bonded carpet with good fiber lock and durability.

It is still another object of this invention to provide a fusion bonded carpet with good combustion performance.

It is a still further object of this invention to provide a fusion bonded carpet which is relatively inexpensive.

Brief Description of the Drawings

FIG. 1 is a simplified side elevation view of apparatus for the first stage of manufacture of carpet in accordance with the present invention using an I-tuft process.

FIG. 2 is a simplified side elevation view of apparatus for the second stage of manufacture of carpet in accordance with the present invention using an I-tuft process.

FIG. 3 is a simplified side elevation view of apparatus for the first stage of manufacture of carpet in accordance with the present invention using a U-tuft process.

FIG. 4 is a simplified side elevation view of apparatus for the second stage of manufacture of carpet in accordance with the present invention using a U-tuft process.

FIG. 5 is a schematic representation of the third stage of manufacture of carpet in accordance with the present invention using either an I-tuft or U-tuft process.

FIG. 6 is a cross sectional view of carpet manufactured in accordance with the present invention using an I-tuft process.

FIG. 7 is a cross sectional view of carpet manufactured in accordance with the present invention using a U-tuft process.

Detailed Description of the Drawings

In one embodiment of the present invention, precursor I-tufted carpet is manufactured as illustrated in FIG. 1 by advancing yarn strands 10 from beams 12 past guide rolls 14 to a belt 16, positioned adjacent and normal to the yarn strands 10 The yarn 10 advances to a predetermined height above the belt 16, where a cutting blade 18, positioned slightly above and parallel to the belt 16 oscillates forward across the edge of the belt 16, severing the

yarn 10 and forcing the cut strands 17 onto the belt 16. The cutting blade 18 then oscillates backward, allowing for the further advancement of yarn strands 10, and repetition of the yarn cutting procedure. Advancement of yarn 10 and oscillation of the cutting blade 18 are synchronized to cause rapid propagation of cut strands 17 onto and across the belt 16, producing a pile yarn aggregation 20 of side-by-side yarns 17 standing on end on belt 16. The pile yarn aggregation 20 travels across the belt 16, over plate 21, and and onto a conveyor 19.

Simultaneously, a web of non-woven fiberglass 22 from roll 24 and a web of fiberglass mesh 28 from roll 26 are advanced together over guide rolls 30 and 32. The nonwoven fiberglass 22 together with fiberglass mesh 28 constitute the primary backing 33. A latex adhesive formulation 34 is dispensed onto the advancing fiberglass mesh 28 which provides a layer 36 of adhesive which penetrates through the fiberglass mesh layer 28 into the nonwoven fiberglass web 22. Uniformity of spread and thickness of the latex 36 is achieved by means of a doctor blade 38. The viscosity of the latex may range from 20,000-150,000 cps (centipoise), with an optimal range of 40,000-120,000 cps.

A portion of the latex formulation 34 penetrates into the fiberglass mesh 28 and nonwoven fiberglass 22, which results in bonding of the two layers 22 and 28 when the adhesive 34 is cured. The desired thickness of the latex layer 36 is dependent on the yarn used and the positioning and density of the yarn strands 17 in the pile yarn aggregation 20. An adhesive layer 36 of thickness of 0.050-0.150 inch is adequate for an I-tufted pile yarn aggregation for

carpet with a final yarn weight in the range of 15-70 ounces/yd^2.

The fiberglass mesh 28 and nonwoven fiberglass layer 22 carrying the latex adhesive layer 36 travels around marriage roller 40, which presses the adhesive 36 into the ends of cut yarn strands 17 of the pile yarn aggregation 20. The yarn strands 17 adhere to the latex layer 36, and the advancing yarn 17 and primary backing 33 composition travels past a heater 42, positioned on the backing 33 side of the composition, which raises the temperature of the latex 36 to the boiling point of water. The temperature must be elevated at a rate sufficiently slow to prevent rapid bubbling of the water out of the latex, which results in the separation of the latex 36 from the cut fibers 17. For example, an IR (infrared) heater with a flux density of 6 - 25 watts/in^2 may be used at 25 - 75% of maximum capacity, with an exposure time of 1 - 5 minutes. The carpet then passes through a high velocity hot-air dryer 44, which blows hot air to remove the moisture expelled from the latex layer 36. The air temperature within the dryer 44 should be 200 - 300°F, and dwell time within the dryer 44 should be 2 - 10 minutes.

The precursor I-tufted carpet 46 with cured adhesive 36 is then either collected onto roll 48, or proceeds directly to Stage II of the I-tuft procedure, as illustrated in FIG. 2.

There, fiberglass mesh 50 from roll 52 is advanced together with and above a web of nonwoven fiberglass 56 from roll 58 under a dispenser 60, which deposits a latex formulation 61 on the fiberglass mesh 50 and nonwoven fiberglass 56. Spreading of the latex 64 is accomplished with a doctor blade 62.

Penetration of the fiberglass mesh 50 and nonwoven fiberglass 56 occur as described in Stage I above. The fiberglass mesh 50 and nonwoven fiberglass 56 is advanced with the simultaneously advancing precursor I-tufted carpet 46 from Stage I (FIG. 1) so that latex adhesive layer 64 contacts yarn ends 65. As the cut yarn ends 65 embed securely into the latex layer, a sandwich structure 66 is formed comprising layers of nonwoven glass 22, fiberglass mesh 28, (cured) latex 36, cut pile yarn aggregation 20, (uncured) latex 64, fiberglass mesh 50 and nonwoven glass 56. The sandwich 66 travels past a heater 68 which raises the temperature of the latex to the boiling point of water at a rate sufficiently slow to prevent rapid bubbling of the water out of the latex. For example, an IR (infrared) heater with a flux density of 6 - 25 watts/in^2 may be used at 50 - 75% of a maximum capacity with an exposure time of 1 -10 minutes. The sandwich 66 then travels through a hot air dryer 70, where hot moisture is removed. A dwell time of 2 - 10 minutes in air at a temperature of 275 - 325°F is sufficient to remove the moisture and cure the latex. The pile yarn aggregation 20 of the sandwich 66 is then severed by splitter 72, to provide two carpet webs 74; which are further dried by hot air dryers 73, and collected onto rolls 75.

In the first stage of the U-tuft embodiment of the present invention, as illustrated in FIG. 3, yarns 78 supplied from beams 80 are fed along with support paper 79 from roll 81 past upper and lower pleater bars 82 and 84, respectively, which reciprocate transverse to the plane in which the yarns 78 and support paper 79 travel to form a pleated yarn aggregation 86. The advancing pleated aggregation 86

advances over bed 85 and is maintained with a rigid sheet 88 which extends between pleater bars 82, 84 and guide roll 90. Advancing fiberglass mesh 92 from roll 94 travels under guide roll 90 to lie against and travel with the pleated aggregation 86.

A nonwoven fiberglass web 96 from roll 98 also travels around guide rolls 100, 102 past a first dispenser 104 which applies a layer 105 of high viscosity latex formulation 109 (50,000-120,000 cps) and a second dispenser 106, which provides a layer 107 of low viscosity latex formulation 111 (10,000-50,000 cps) on top of the layer of high viscosity latex formulation 105. Uniformity of spread and thickness of each latex layer is achieved with doctor blades 108 and 110 positioned after each latex dispenser 104 and 106. The nonwoven fiberglass 96 with latex adhesive upper coatings 105 and 107 then travels around guide roll 112 and is pressed by marriage roller 114 into contact with the fiberglass mesh 92. The low viscosity latex formulation layer 107 penetrates through the fiberglass mesh 92 and into the yarn pleating 86, securing the pleats in the adhesive. The high viscosity latex layer 105 penetrates into the fiberglass mesh 92, bonding it to the nonwoven glass layer 96. The fiberglass mesh layer 92 and the nonwoven glass layer 96 together form support layer 95 (See Figure 7).

Support paper 77 is pulled from the pleated yarn aggregation 86 by a motor driven master roll 115 with slave roll 117, positioned past and below bed 85. The paper is collected onto beam 119.

The nonwoven fiberglass 96, with fiberglass mesh 92 and pleated pile 86 underneath, advance onto belt 113 and travels past a heater 116 and high velocity

hot-air dryer 118, under the conditions described above for Stage I of the I-tuft procedure (Fig. 1). The precursor U-tufted carpet 120 so formed may be collected onto roll 122 or may proceed directly into Stage II of the U-tuft procedure, as illustrated in FIG. 4.

In Stage II of the U-tuft process of the present invention, as illustrated in Fig. 4, nonwoven fiberglass web 124 from roll 126 is advanced together with fiberglass mesh 128 from roll 130 around guide roll 132 and 134 and past a first dispenser 136 which applies a layer of high viscosity latex formulation 138 (40,000-120,000 cps) to the surface of the fiberglass mesh; and past a second dispenser 140, which provides a layer of low viscosity latex formulation 142 (10,000-50,000 cps) on top of the high viscosity latex formulation 138. Uniformity of spread and thickness of each latex layer is achieved with doctor blades 144, 146. The high viscosity latex layer 138 penetrates through the fiberglass mesh into the nonwoven glass. The fiberglass mesh 128 and nonwoven fiberglass web 124 carrying the latex adhesive layer 142 travel past guide roll 148 to marriage roll 150 where the adhesive 142 is pressed into contact with the unbonded pleated pile 151 of the precusor U-tufted carpet 120 from Stage I of the U-tufted process (FIG. 3). The low viscosity latex formulation layer 142 penetrates into the unbonded pleated pile 151 surface of the precursor U-tufted carpet 120, securing the pleats into the adhesive 142. A U-tufted sandwich 152 results, comprising layers of nonwoven glass 124, fiberglass mesh 128, (uncured) latex 138, 142, pleated pile 86, (cured) latex 105, 107, fiberglass mesh 92 and nonwoven glass 96. This

U-tuft sandwich travels past a heater 154, and then through a hot air oven 156 to remove the hot moisture, under the same conditions as described in Stage II of the I-tuft procedure (FIG. 2). The pleated yarn of the U-tufted sandwich is then severed by splitter 158, to provide two U-tufted carpet webs 160, further dried by hot air dryers 161 and collected onto rolls 162.

In one embodiment of the present invention, a nonwoven fiberglass layer is laminated to the I-tufted or U-tufted carpet sheet 74 or 160 before a secondary backing, if desired, is applied. This fiberglass mesh support layer allows for added dimensional stability of the final carpet product, as described in U.S. Patents 4,010,301 and 4,010,302. This is illustrated in FIG. 5 where I-tufted 74 or U-tufted 160 carpet webs from rolls 76 or 162 respectively, travel past guide roll 164 to a first dispenser 166 which applies a puddle of laminating adhesive 167 to back of the carpet. This laminating adhesive 167 may be a nonlatex PVC plastisol, or a compatible latex adhesive. Doctor blade 168, positioned after the first dispenser, insures the proper thickness and spread of the adhesive layer 169. Simultaneously, nonwoven fiberglass 170 from roll 172 travels around guide roll 174 past a second dispenser 176 which applies a layer of laminating adhesive 177 to the surface of the nonwoven fiberglass 170, a portion of which penetrates into the fiberglass. Doctor blade 178, positioned after the dispenser, insures proper thickness and spread of the laminating adhesive layer 177. The nonwoven fiberglass 170 with laminating adhesive layer 177 then travels past guide roll 180 to a first heating means 182, where the adhesive layer 177 on the nonwoven fiberglass 170 contacts laminating

adhesive layer 169 of the carpet web 74 or 160. The heating means should be at a temperature sufficient to cure the adhesive. For example, hot oil drums at a temperature from 400°F to 475°F may be employed when the adhesive is a nonlatex PVC plastisol. The carpet web 74 or 160 with adhesives 169, 177 and nonwoven fiberglass support 170 proceeds past guide rolls 184, 186 past a second heating means 188 to further cure the adhesive. The temperature range of the second heating means may be in the same range as that of the first heating means. Optionally, the carpet web so produced 189 or 191 continues around guide rolls 190, 192, past a cooling means 194 to guide roll 196. For example, the cooling means 194 may be a cool water drum.

In an alternate embodiment, if the nonwoven fiberglass is not desired in the secondary backing, the carpet web 74 or 160 from rolls 76 or 162, respectively may advance directly to guide roll 196. In either embodiment, the carpet travels past a third dispenser 198 which applies a liquid secondary backing material 199 to the back of the carpet. Doctor blade 200 or coater 201 (not illustrated) insures uniformity of spread and thickness of the backing layer 202. The liquid secondary backing material 199 is generally of a viscosity range 10,000 - 20,000 cps. Liquid secondary backing materials include high viscosity PVC plastisol, atactic polypropylene, polyvinylidene chloride, bitumen, ethylene-vinyl acetate, hot melt formulations and urethanes. The liquid secondary backing materials may be formulated with fillers, flame retardants, thickeners or other compounds to increase their usefulness as carpet backing.

The carpet web 74 or 160 with liquid secondary backing material 202 proceeds through curing means 204, which solidifies the backing material. If the curing means is heat, it is important that it not be directed to the pile surface of the carpet in order to protect the pile yarn from charring.

The carpet web 74 or 160 with cured secondary backing 202 advances, optionally, past cooling means 206 to roller 208 or alternatively, to a die press 33 for the manufacture of carpet tile.

In yet another embodiment of the present invention, not illustrated, a solid secondary backing may be laminated to the carpet sheets formed in accordance with FIG. 1 through 4. Typical solid secondary backing materials include urethane films, woven or nonwoven fabrics, or plastic films made from polyester, polyamides, polyethylene EVA or PVC. Adhesives for these solid secondary backing materials include atactic polypropylene, hot melts, SBR, VAE, EVA, PVDC, PVC and urethane.

FIG. 6 is a cross sectional view of carpet 189 manufactured in accordance with the present invention using an I-tuft process and the apparatus of FIGS. 1, 2 and 5. Cut yarn strands 17 form a pile yarn web 20 such that only one end of each yarn strand protrudes out of the upper surface of a latex adhesive base layer 36. Support layer 33 of fiberglass mesh layer 28 and nonwoven glass 22 is adjacent to the lower surface of the latex adhesive base 36. A second layer of nonwoven fiberglass 170 is positioned beneath the nonwoven fiberglass 22 and secondary backing 202 is beneath the nonwoven fiberglass 170. FIG. 6 further illustrates the manner of adhering the carpet layers according to the present invention. The latex

adhesive 34 penetrates through the first fiberglass mesh layer 28 into the nonwoven fiberglass 22 where it contacts and bonds with liquid adhesive 167 used to laminate the second layer of nonwoven fiberglass 170 to the nonwoven fiberglass 22. The liquid adhesive 167 embedded in the second nonwoven fiberglass layer 170 further contacts and bonds with the secondary backing material 199. In the preferred mode, the liquid adhesive has the same composition as the secondary backing material, minimizing the number of bonding adhesive interfaces.

Carpet 191 manufactured in accordance with the present invention using a U-tufted process, illustrated in Fig. 7, is identical in structure to the carpet 189 illustrated in FIG. 6, with the exception that the pile yarn web 86 comprises folded yarn strands, which are secured in an adhesive base layer 107 or 142 such that both ends of each folded strand protrude from the base.

One of the advantages of the present invention over the prior methods of preparation of fusion bonded carpet is that a variety of secondary backings may be employed.

As described above, in carpet made in accordance with the present invention, for example, as illustrated in Fig. 6, there may be two polymeric bonded interfaces, that of the latex adhesive fusion bonding material 36 with the adhesive 167 used to adhere the second nonwoven fiberglass support layer 170, and that of the adhesive 167 with the secondary backing material 199 or adhesive used to bind the secondary backing. In the preferred mode, the adhesive 167 has the same composition as the secondary backing material 199 or adhesive used to bind the

secondary backing, minimizing the number of polymeric bonding interfaces to one.

Nonlatex PVC plastisol as the pile yarn web bonding adhesive limits the choice of adhesives which may be used in carpet construction because nonlatex PVC plastisol does not bind adequately to common carpet adhesives and backing materials such as bitumen, EVA, APP, hot melts, urethanes or SBR. When the adhesive of the fusion bonded carpet forms a weak bond with the adjacent polymeric formulation, there is a potential for carpet peel, which reduces the useful life of the carpet. Latexes described in the present invention will bond adequately to most common backing materials, to form a carpet product that will not peel over time.

Examples of latexes that may be employed in the fusion bonding adhesive formulation include vinyl acetate-ethylene, ethylene-vinylacetate, styrene-butadiene, latex polyvinyl chloride, polyvinylidene chloride, vinyl acetate acrylic acid or ester, styrene acrylic acid or ester, acrylic or methacrylic acid or their esters, and copolymers of these compounds.

The latex may be formulated with other compounds to increase its suitability as a fusion bonding adhesive and to impart added beneficial properties to the carpet. See Table I in Example I. For example, a flame retardant may be added such as alumina trihydra · ATH), which at high temperature generates steam instead of smoke. Other flame retardant compounds include carbonates, such as $CaCO_3$, $MgCO_3$, $BaCO_3$, and metal oxides, borates, sulfonates and phosphates.

A dispersing agent may be added to the latex formulation to insure that the flame retardant is

sufficiently evenly distributed. An example is Narlex-LD 45 by National Starch and Chemical Corporation.

A defoamer may be added to increase the density of the adhesive on curing. An example of a defoaming agent is Foammaster VF from Henkel Corporation.

The viscosity of the latex adhesive may be adjusted as necessary with a thickener such as Natrosol 250HR by Hercules, Inc. or Paragum 141 by Parachem Southern, Inc. Natrosol 250 HR is activated at a pH greater than 7.0, and therefore a base such as ammonia may be added to the latex formulation to increase the pH as necessary.

Catalysts may be added to crosslink the latex. For example, ammonium chloride acts as a catalyst to crosslink vinylacetate - ethylene. Crosslinking of a latex adhesive with the aid of compounds such as melamine is beneficial to prevent softening and degradation of the adhesive layer on exposure to water.

The present invention may be further understood by reference to the following working example which is intended to illustrate the invention only, and not limit its scope.

Example I

A carpet is prepared in accordance with FIGS. 1 and 2 or FIGS. 3 and 4, with a latex adhesive formulation as described in TABLE I.

TABLE I

FORMULAE

Ingredient	Parts By Weight
Latex	180 - 250
Alumina Tri-Hydrate	50 - 250
Ammonium Chloride	0 - 10
Ammonia	as required to raise pH above 7.0 if Natrosol 250 HR is used
Narlex-LD 45 (Dispersing Agent for ATH)	0 - 3
Defoamer	0 - 3
Natrosol 250HR (Thickener)	as required
Cymel 373	0 - 10

Example II

A carpet is prepared in accordance with FIGS. 1 and 2 or FIGS. 3 and 4, with a latex adhesive formulation as described in TABLE II.

TABLE II

VAE Adhesive Formula

Ingredient	Parts By Weight
VAE Latex	192
Aluminum Tri-Hydrate	100
Ammonium Chloride	3.9
DeFoamer	0.1
Ammonia	as needed to give pH of 7.5
Natrosol 250 HR	as needed to give desired viscosity

TABLE III

Ingredient	Parts By Weight
SBR latex	200
$Al(OH)_3$	100
defoamer	0.1
dispersant	0.1
Paragum 141	as needed

TABLE IV

Ingredient	Parts By Weight
Vinyl acetate acrylic ester	217
$Al(OH)_3$	100
defoamer	0.1
dispersant	0.1
Paragum 141	as needed

This description is given for purposes of illustration and explanation. It will be apparent to those skilled in the relevant art that modifications and changes may be made to the invention as described above without departing from its scope and spirit.

We claim:

1. A carpet comprising pile yarn secured to a support layer with a latex adhesive formulation wherein the latex adhesive is selected from the group consisting of vinyl acetate-ethylene, ethylene-vinyl acetate, styrene-butadiene, latex polyvinyl chloride, polyvinylidene chloride, vinyl acetate acrylic acid or ester, styrene acrylic acid or ester, acrylic or methacrylic acid or their esters, and copolymers of these compounds.

2. The carpet of claim 1, comprising:

(i) cut yarn strands forming a pile yarn aggregation;

(ii) a latex adhesive base wherein the pile yarn aggregation is secured and from which the aggregation protrudes;

(iii) a fiberglass support layer adjacent to the surface of the latex adhesive base opposite the surface from which the pile yarn aggregations protrude;

(iv) a layer of nonwoven fiberglass adjacent to the surface of the fiberglass support layer opposite the surface contacting the latex adhesive base; and

(v) a secondary backing adjacent to the surface of the nonwoven fiberglass opposite that contacting the support layer.

3. The carpet of claim 2, wherein the secondary backing is selected from the group

consisting of nonlatex PVC plastisol, APP, PVDC, PVC, bitumen, urethane, EVA, hot melts and SBR.

4. The carpet of claim 2, wherein the secondary backing is selected from the group consisting of woven or nonwoven fabrics, or urethane, polyester, polyamide, polyethylene, ethylene-vinylacetate or polyvinyl chloride films.

5. A method for manufacturing carpet comprising securing pile yarn to a support layer with latex adhesive wherein the latex adhesive is selected from the group consisting of vinyl acetate-ethylene, ethylene-vinylacetate, styrene-butadiene, latex polyvinyl chloride, polyvinylidene chloride, vinyl acetate acrylic acid or ester, styrene acrylic acid or ester, acrylic or methacrylic acid or their esters and copolymers of these compounds.

6. A method of manufacturing carpet, comprising:

(i) advancing yarn strands to a predetermined height above a bed;
(ii) severing the yarn to form a pile yarn aggregation,
(iii) providing a fiberglass support layer;
(iv) applying a layer of latex adhesive to the fiberglass support layer;
(v) pressing the pile yarn aggregation into the layer of latex adhesive to form a precursor carpet web; and
(vi) curing the latex.

7. The method of claim 6, further comprising:

(i) providing a second fiberglass support layer;

(ii) applying a layer of latex adhesive to the second fiberglass support layer;

(iii) pressing the unbonded pile yarn ends of the precursor carpet web into the layer of latex formulation;

(iv) severing the pile yarn aggregation to provide two carpet webs; and

(v) curing the latex.

8. A method of manufacturing carpet, comprising:

(i) advancing yarn past pleater bars to form an unbonded pleated yarn aggregation;

(ii) advancing a fiberglass support layer;

(iii) applying a latex adhesive to the fiberglass support layer;

(iv) pressing the unbonded pleated yarn aggregation into the layer of latex adhesive to form a precursor pleated carpet web; and

(v) curing the latex.

9. The method of claim 8, further comprising:

(i) providing a second fiberglass support layer;

(ii) applying a latex adhesive to the second fiberglass support layer;

(iii) pressing the unbonded pleated ends of the precursor pleated carpet web into the layers of latex formulation;

(iv) curing the latex; and

(v) severing the pleated yarn aggregation to provide two carpet webs.

10. The method of claims 6 or 8 further comprising:

(i) adhering a layer of nonwoven fiberglass to the surface of the support layer opposite the pile yarn; and

(ii) adhering a secondary backing to the surface of the nonwoven fiberglass opposite that contacting the support layer.

11. The method of claims 10, wherein the secondary backing is selected from the group consisting of nonlatex PVC plastisol, APP, PVDC, PVC, bitumen, urethane, EVA, hot melts and SBR.

12. The method of claim 10, wherein the secondary backing is selected from the group consisting of woven or nonwoven fabrics, or urethane, polyester, polyamide, polyethylene ethylene-vinylacetate or polyvinyl chloride films.

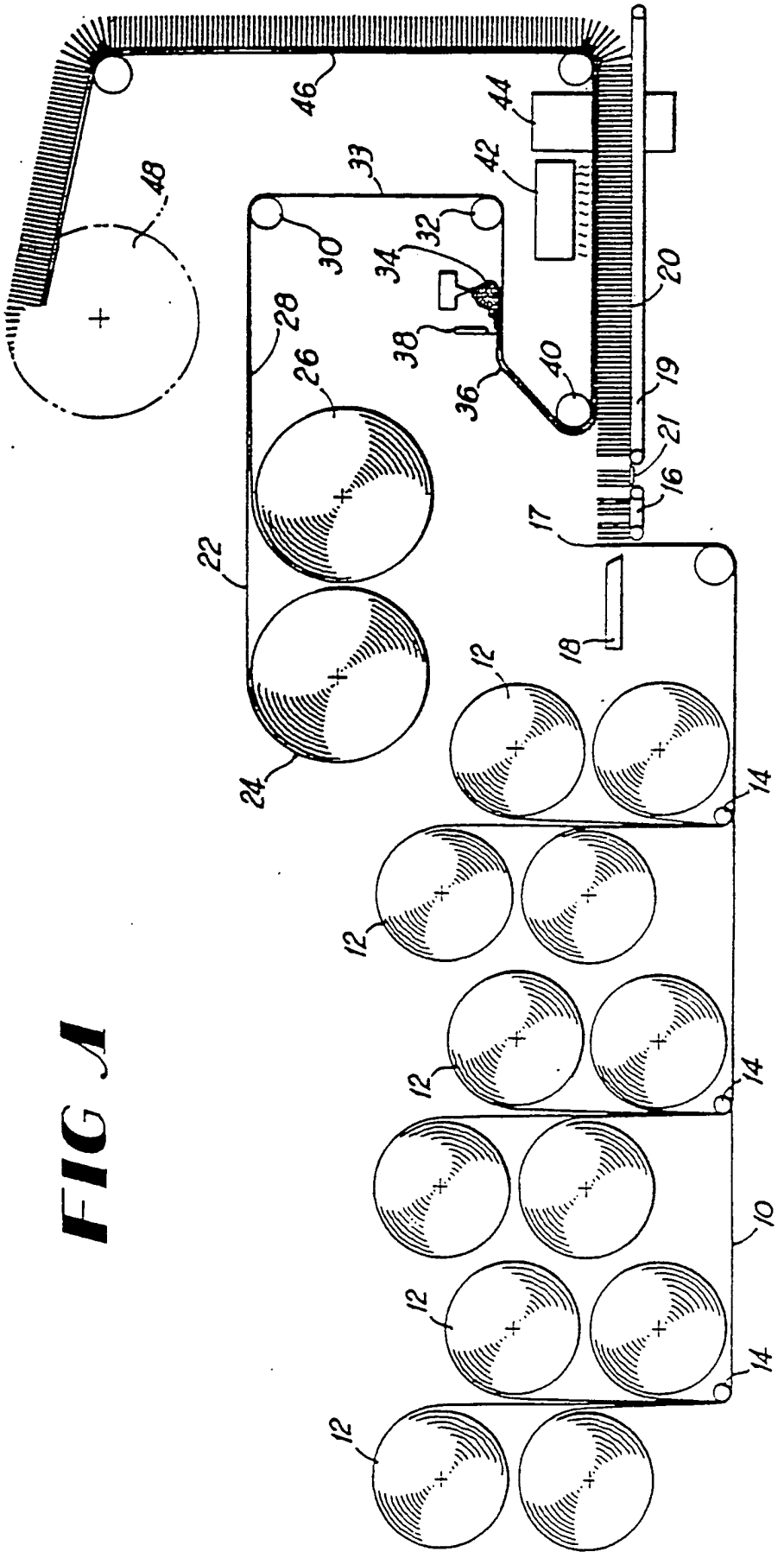
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FIG A

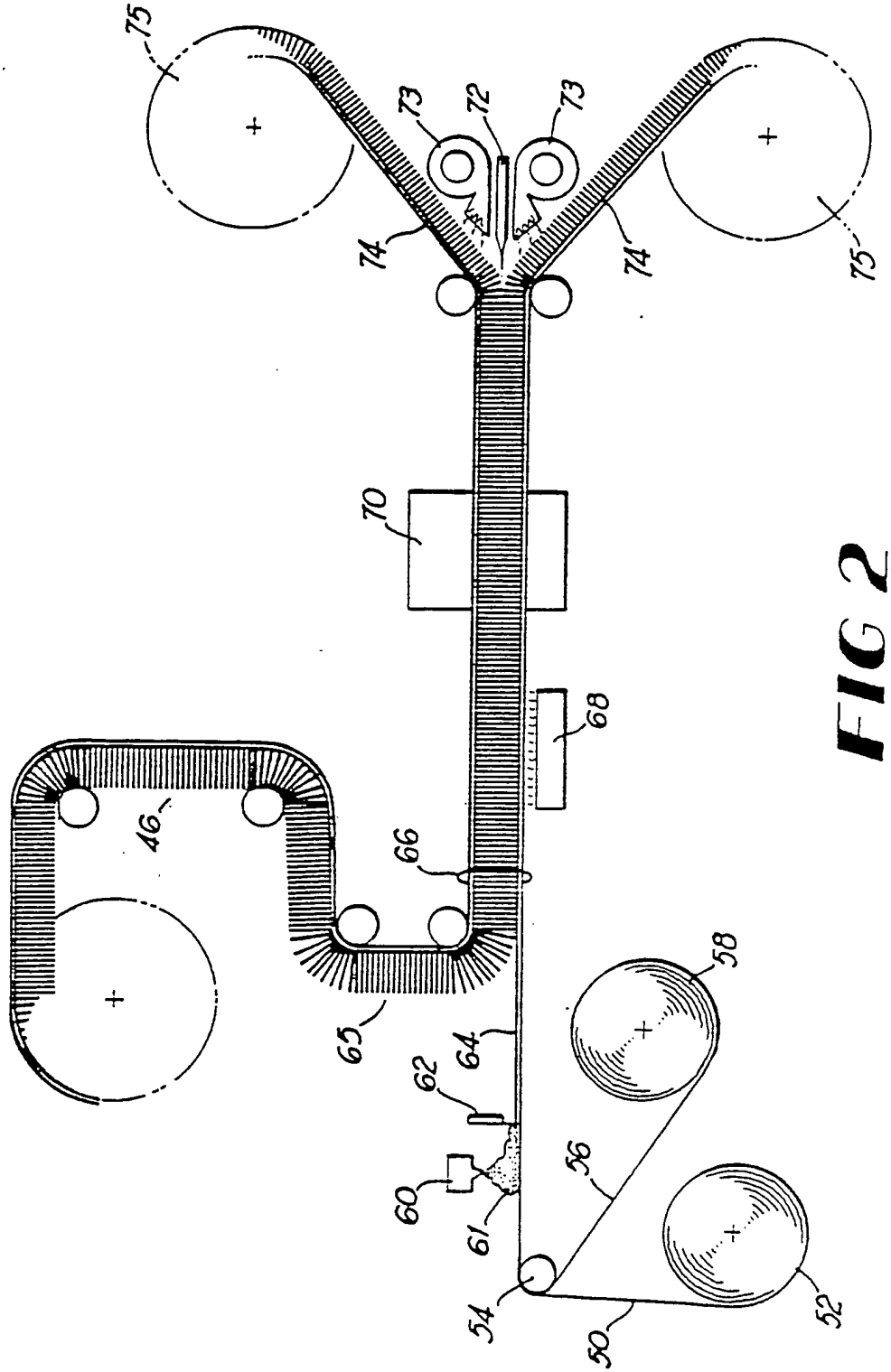

FIG 2

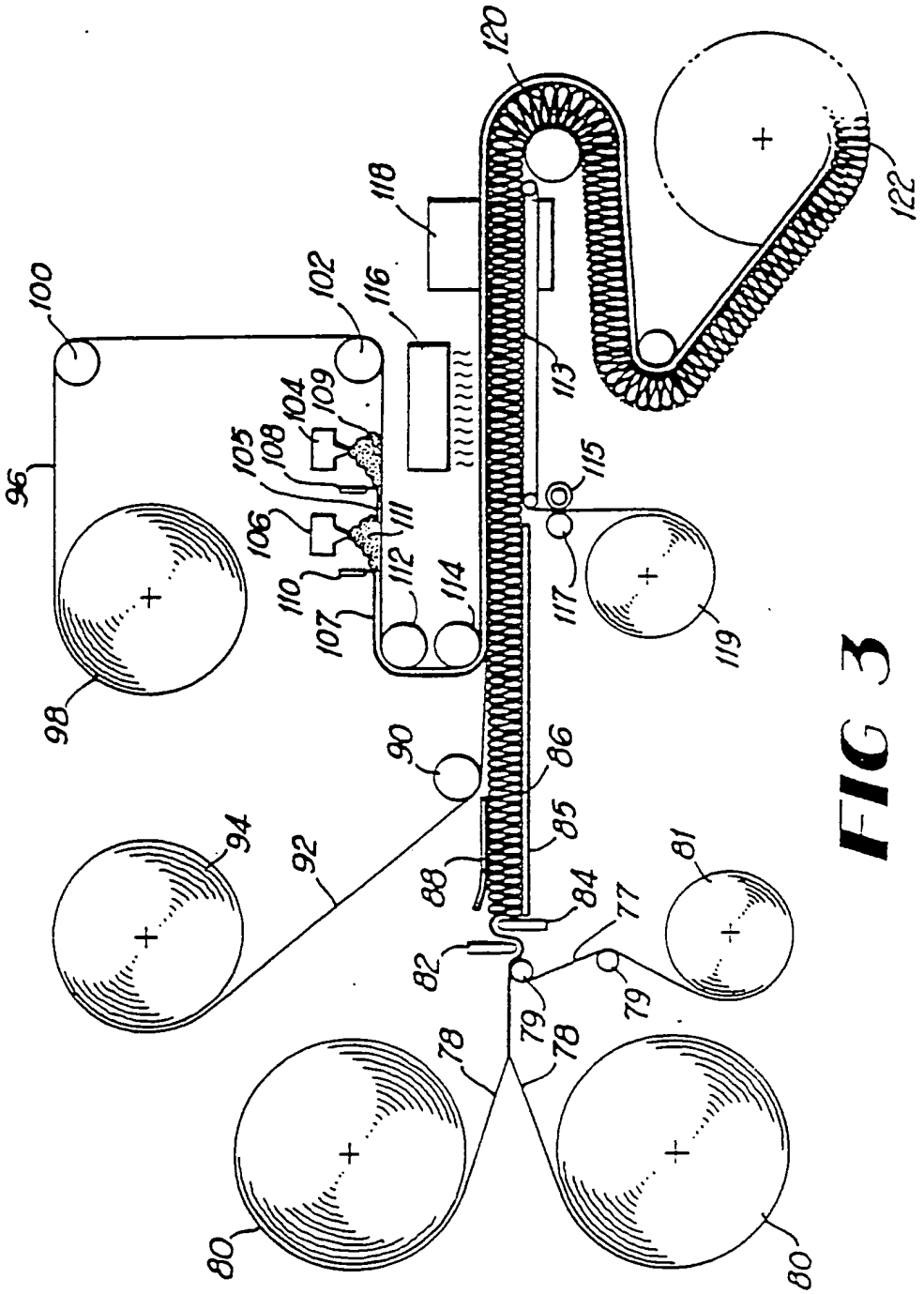
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FIG 3

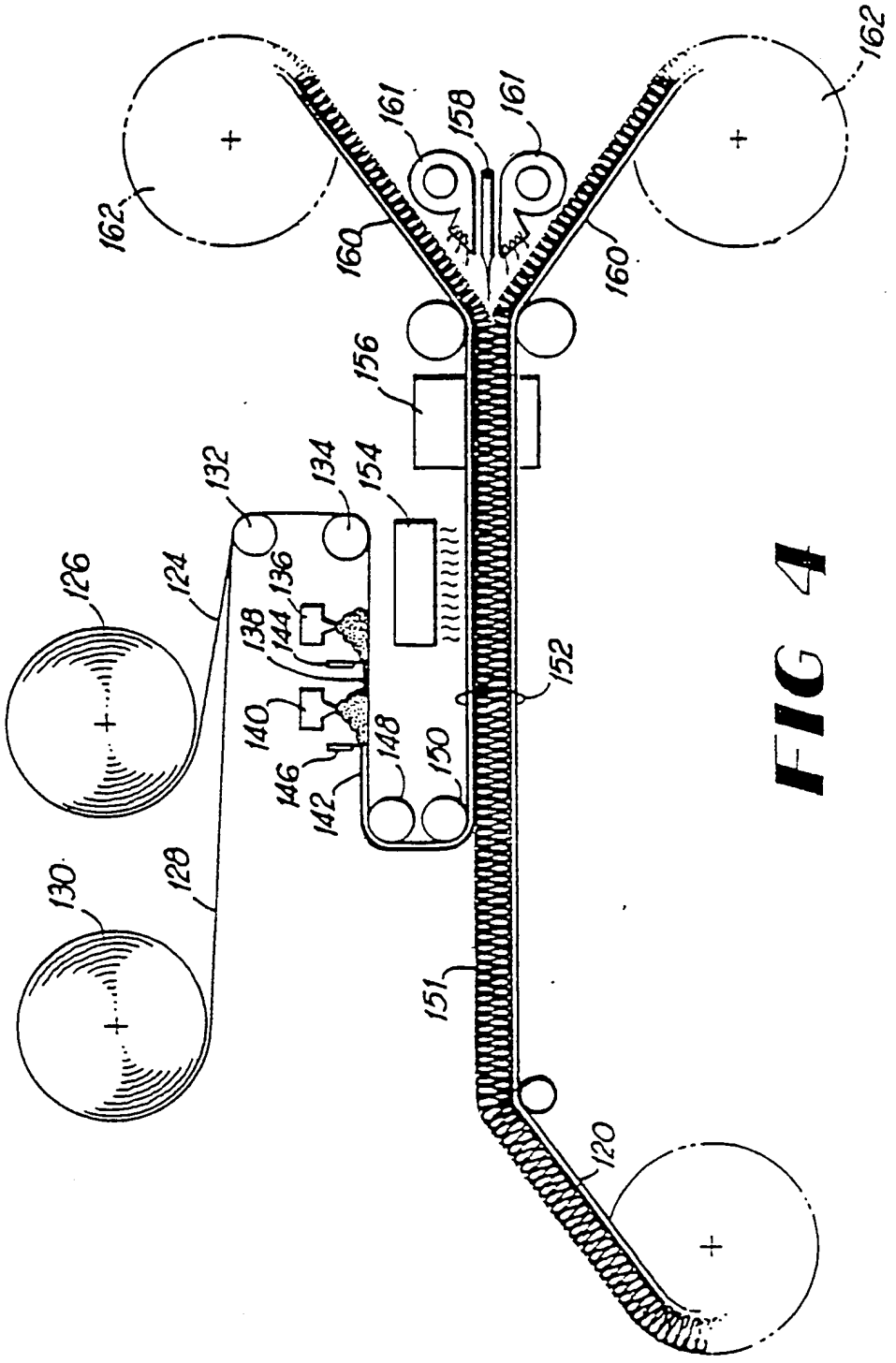
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FIG 4

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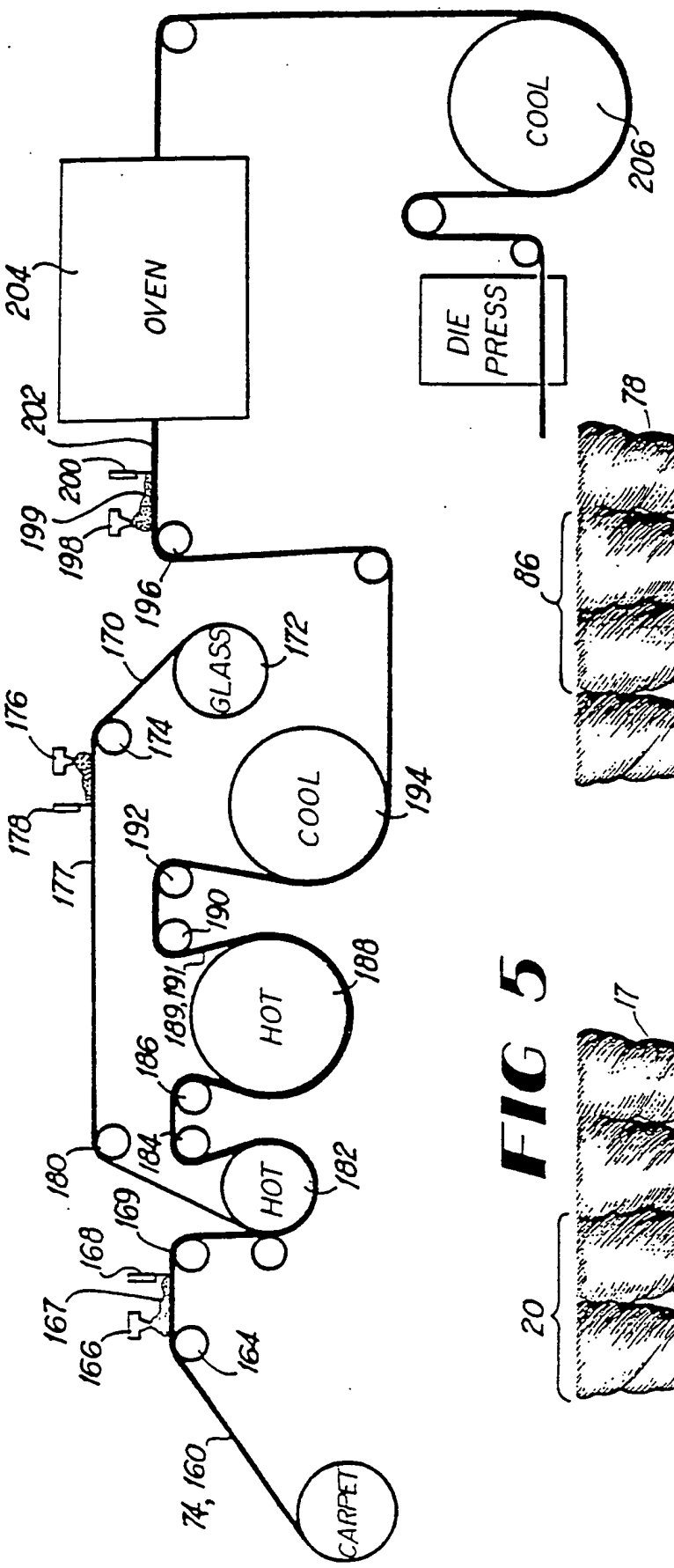

FIG 5

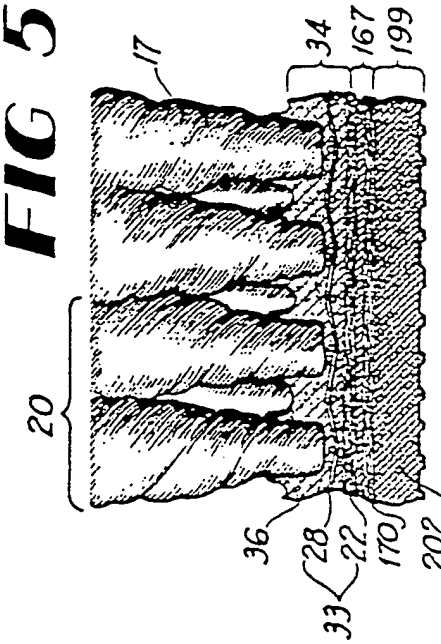

FIG 6

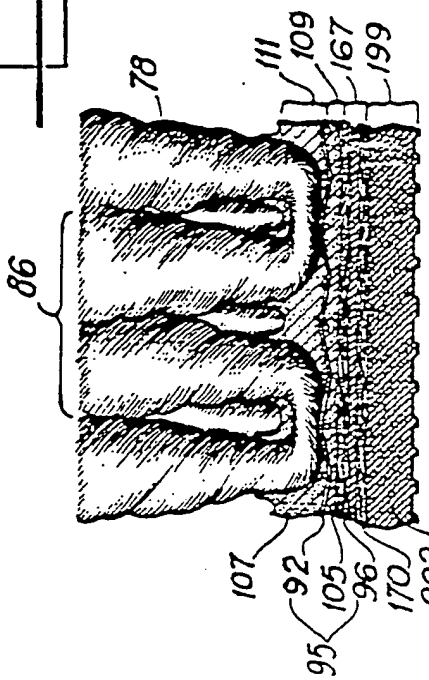

FIG 7

INTERNATIONAL SEARCH REPORT

International Application PCT/US89/02766

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

INT. CL.4: B32B 3/02; B32B 31/00

US. CL: 156/72; 428/95

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
US	428/82, 95, 97; 156/72

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	US, A, 4,522,857 (HIGGINS) 11 JUNE 1985	1-12
A	US, A, 4,689,256 (SLOSBERG) 25 AUGUST 1987	1-12
A,P	US, A, 4,808,459 (SMITH) 28 FEBRUARY 1989	1-12

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search

25 SEPTEMBER 1989

Date of Mailing of this International Search Report

11 OCT 1989

International Searching Authority

ISA/US

Signature of Authorized Officer

for W. J. VANBALEN